

CLAIMS

WHAT IS CLAIMED IS:

1. In a tray– fed scanning acoustic microscope, an improved tray– scanning station for inspecting perforate trays of loosely held parts, comprising:
 - a tray conveyor;
 - a coupling fluid dispenser;
 - an ultrasonic beam generator configured to direct an ultrasonic beam through the coupling fluid onto the trays during scanning of the trays, the dispensed coupling fluid undesirably tending to agitate the parts during scanning; and
 - a vacuum system configured to draw a vacuum on the bottom of the trays during tray scanning.
2. The apparatus of claim 1 wherein said trays each have a perforate bottom wall, and wherein said vacuum system includes a plenum chamber having a wall with vacuum openings addressing said bottom wall of said perforate tray during the scanning operation to draw air into said tray and out through said bottom wall thereof, thereby to at least assist in immobilizing the parts during the scanning operation.
3. The apparatus of claim 1 including an X– motion stage coupled to said ultrasonic beam generator, said vacuum system including an array of suction apertures aligned with an X axis motion of travel of said beam generator.
4. The apparatus of claim 1 including an X– Y– motion stage coupled to said ultrasonic beam generator, said vacuum system including an X– Y array of suction apertures aligned with an X– Y axis motion of travel of said beam generator.
5. The apparatus of claim 1 wherein said vacuum system includes a diaphragm pump.

6. The apparatus of claim 1 wherein said vacuum system recirculates to the coupling fluid dispenser coupling fluid drawn from the trays during ultrasonic inspection of the parts.

7. The apparatus of claim 1 including a stationary parts– hold– down structure situated between said ultrasonic beam generator and trays being conveyed through the tray– scanning station, said structure conducting coupling fluid from said dispenser to the trays of parts through at least one opening therein which is sized and positioned to also pass the ultrasound beam from said ultrasonic beam generator.

8. The apparatus of claim 7 wherein said ultrasonic beam generator is translated transverse to the path of the trays and said opening is a transverse slot of sufficient width in the direction of tray movement to pass coupling fluid and said transversely moved ultrasound beam.

9. The apparatus of claim 1 including a drying station for drying trays of parts which have been insonified.

10. The apparatus of claim 9 wherein said drying station includes a vacuum dryer for drawing fluid from said trays and parts.

11. The apparatus of claim 10 wherein said vacuum dryer and said vacuum system employ a common vacuum pump.

12. The apparatus of claim 11 including an allocator valve coupled to said pump and configured to allocate pump head to said dryer and said vacuum system.

13. The apparatus of claim 12 including control means operatively coupled to said allocator valve.

14. The apparatus of claim 9 wherein said drying station includes:

a parts dryer, the dryer undesirably tending to dislodge the parts from the trays; and

a stationary parts– hold– down device situated closely contiguous to the trays, said hold– down device having a pattern of openings sized and positioned to preclude the parts from being dislodged from the trays by the parts dryer as the trays move past the device.

15. The apparatus of claim 7 including:

a parts dryer for directing a stream of forced gas onto wet trays of parts which have been insonified in coupling fluid, the forced gas undesirably agitating the parts and tending to dislodge them from the trays; and

a second stationary parts– hold– down device situated between said dryer and the trays and closely contiguous to the trays, said hold– down device having a pattern of openings sized and positioned to pass the stream of forced gas to the trays while precluding the parts from being dislodged from the trays by the dryer as the trays move past the device.

16. The apparatus defined by claim 1 wherein said trays each have a perforate bottom, and wherein said vacuum system includes a series of suction elements addressing said bottom of said perforate tray during the scanning operation.

17. The apparatus defined by claim 16 wherein said suction elements are connected to a pump through a vacuum distributor.

18. The apparatus of claim 17 including a vacuum commutator through which suction developed by said pump is selectively coupled to said suction elements.

19. The apparatus of claim 1 wherein said vacuum system includes means for developing localized suction in the region of said ultrasonic beam generator.

20. The apparatus of claim 19 including a beam motion stage configured to cause said ultrasonic beam generator to scan said trays, and tracking means for causing the localized region of suction to track the movement of said beam generator.

21. The apparatus of claim 20 wherein said tracking means comprises a second motion stage coupled to a plenum chamber and configured to move said chamber in synchronism with movement of said beam generator by said beam motion stage.

22. The apparatus of claim 20 wherein said tracking means includes a plenum chamber and wherein said plenum chamber and beam generator are ganged together and moved as one by a common motion stage.

23. The apparatus of claim 22 wherein said common motion stage is an X– Y motion stage.

24. The apparatus of claim 20 wherein said tracking means comprises a series of elements coupled to a pump through a suction distributor and commutator.

25. The apparatus of claim 24 wherein said suction tracking means includes control means operatively coupled to said suction commutator.

26.. A method useful in a tray– fed scanning acoustic microscope, comprising:
conveying a perforate tray of loosely held parts through a scanning station;
in the scanning station insonifying the tray with an ultrasonic beam passed through a falling stream of coupling fluid;
during the scanning operation, drawing a vacuum on the tray to at least assist in securing and immobilizing the parts in the tray.

27. The method of claim 26 wherein said vacuum is drawn with a diaphragm pump.

28. The method of claim 26 including recirculating the coupling fluid entrained in the vacuum for repeated use in the insonifying operation.

29. The method of claim 26 including drying the trays of parts after they have been insonified.

30. The method of claim 29 wherein the drying operation includes use of a gas stream.
31. The method of claim 29 wherein the drying operation includes drawing a vacuum on the trays to assist in drying the trays.
32. The method of claim 26 including applying said vacuum locally only in a suction region surrounding the ultrasonic beam.
33. The method of claim 32 including causing the suction region to move with the beam as it is scanned.
34. The method of claim 33 including providing a plenum chamber having a vacuum, and wherein said suction region is developed using said plenum chamber.
35. The method of claim 34 including moving said plenum chamber in synchronism with movement of said beam generator.
36. The method of claim 33 including providing a series of suction elements coupled to a pump through a suction distribution system and a suction commutator, and creating said suction region with said suction elements.
37. The method of claim 36 including programming the commutator to cause a region of suction to track movement of the beam generator.